Report on 2004 Monitoring of *Lampsilis higginsii* Released into the Wisconsin River near Orion and Prairie du Sac, Wisconsin.

Wisconsin Department of Natural Resources.

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ACKNOWLEDGEMENTS

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INTRODUCTION

This is a report on the 2004 monitoring of *Lampsilis higginsii* placed on caged fish and free-release fish in the Wisconsin River, Wisconsin during 2001-2004. This effort was part of mussel propagation related to the continued operation and maintenance of the Mississippi River System Navigation project by the U. S. Army Corps of Engineers in cooperation with associated, multi-agency Mussel Coordination Team. Persons involved in this 2004 monitoring were staff from the Wisconsin Department of Natural Resources and the U. S. Fish and Wildlife Service, Genoa National Fish Hatchery.

From 2001-2004, 56 mesh-bottomed and 6 solid-bottomed cages containing various fishes artificially inoculated with at least 161,000 glochidia of the federally endangered *Lampsilis higginsii* (mollusca: bivalvia: unionidae) were placed at several locations near Orion on the lower Wisconsin River. In addition to cages, 1679 unconfined, inoculated fish containing at least 119,000 glochidia were released in the vicinity of Prairie du Sac on the lower Wisconsin River. Details of these releases are summarized in Table 1. Fish and mussel propagation, rearing, inoculation methods and cage design are described in Gordon, 2001 and Gordon and Brady, 2003.

During 2004, we sampled mussels in the vicinity of these introduction sites to determine whether there were juvenile *L. higginsii* present that may have resulted from these efforts.

METHODS

At the Orion site, we collected mussels by hand-excavating 60 0.25m² quadrats at the upstream mesh-bottomed cage site and 55 0.25m² quadrats at the downstream mesh-bottomed cage site. Sampling was done during 3 and 14 September, 2004. Five quadrats were taken along each of 11 or 12 stratified transects placed perpendicular to the current direction. Quadrats were taken every 3m along each transect starting at 1m from shore. Transects were placed every 15.2m starting at 15.2m downstream of each of the two cage sites (Figures 1 & 2). Transects were done from 15m-185m downstream of the cage site. These distances were based on preliminary glochidial drift calculations forwarded by D. Kelner (U.S. Army Corps of Engineers, Pers. Comm.) who suggested that *Lampsilis* glochidia could drift about 23m at a current velocity of 0.5 fps, 46m at 1.0 fps and 70m at 1.5 fps.

All mussels, both living and dead, were identified, counted and measured for total length and height. After the quadrats were completed, we spent additional time “free diving” at locations where juvenile mussels were common or where *L. higginsii* was found. The purpose of these dives was to obtain a larger sample of mussels than was found in the quadrats.

At the solid-bottomed cage site (Figure 3), we hand searched a radius of 2m around each cage, then lifted the cage and searched its contents. We then returned to the cage site and searched the same radius for any mussels that may have fallen out during removal. Location of this sold-bottomed cage site is given in Figure 3.

At the Prairie du Sac fish free-release sites, we conducted two different sampling schemes during 31 August to 2 September 2004. At the downstream release site near Hwy 12, we did stratified quadrats placed along stratified transects downstream of the release site (Figure 4). Here we took 60 0.25m² quadrats along 12 transects. This method was identical to sampling done at Orion.

Also, during the previous year, 2003, we took samples from 20 1m² quadrats very near the release site. During this sampling there were 5 quadrats placed 1m apart along 4 transects placed 2m apart. The upstream transect was at the free-release site.

The second 2004 sampling scheme was used at the upstream free-release site. At this site we used a random, rather than stratified scheme. We sampled 122 1m² randomly placed quadrats (Figure 5). We spent additional time "free diving" at locations where juvenile mussels were common.

RESULTS AND DISCUSSION

Orion

Total mussel population density was 2.82/m² downstream of the Orion mesh-bottomed cage sites. This compares to 1.34/ m² for the entire 8km long Orion mussel bed sampled randomly in 2002. Densities by species are given in Table 2. At the upstream release site, the mean total mussel density was 2.93/m² while the density at the downstream site was 2.69/m².

A single specimen of *L. higginsii* was found 93m downstream of the lower cage location. The mean population density of this species was 0.03/m² and ranked 10th out of 10 in abundance. The 90% confidence interval for the *L. higginsii* population estimate within the two areas sampled combined is 0 to 494 individuals based on a study area of 5875m². The point estimate (mean) is 206. These 206 estimated individuals represent 0.14% of the total estimated number of transformers released to the site since 2001. These estimates do not include any artificially propagated mussels that may have been deposited outside of the areas sampled. The study areas sampled were no more than 190m downstream of the cage locations.

The single *L. higginsii* found was a juvenile. It measured 25mm by 16mm (length, height) and was aged at one year. The specimen may have had two rather than one annuli. One growth check may have been a disturbance ring rather than an annulus (Figure 6). This disturbance ring may have been caused by mid-June 2004 flood flows that were three times that months average flows.

There is no way at present to know if this individual resulted from our artificial propagation efforts. It is probable that this individual came from the 2003 introductions and was not a naturally propagated individual. Considering its location 93m downstream of a cage site and the extreme rarity of juvenile *L. higginsii* in the lower Wisconsin River, it seems less likely that it's a natural recruit. Prior to 2004, the smallest *L. higginsii* specimen of 41 found in the lower Wisconsin River was 55m in total length. A total of 90% of the specimens found were over 70mm. It seems that small, natural recruits are rare to the Wisconsin River.

At the solid-bottomed cage site few mussels were found in the two remaining of six cages. These two cages were half filled with sand from a substantial spring flood. We found only two young-of-the-year *Pyganodon grandis*.

Prairie du Sac

Total mussel population density was 3.60/m² in 2004 stratified 0.25m²quadrats downstream of the lower Prairie du Sac free-release site. This compares to 2.75/m² for the entire 2.5km long Prairie du Sac mussel bed sampled randomly in 2004. Densities by species are given in Table 3. No specimens of *L. higginsii* were found in these stratified samples. A total of 11.3% of the specimens found were smaller than 25mm and 25% were between 25 and 50mm.

Total mussel population density was 2.75/m² in 2003 stratified 1m²quadrats at and downstream of the lower Prairie du Sac free-release site. Densities by species are given in Table 5. No specimens of *L. higginsii* were found in these stratified samples. A total of 13.3% of the specimens found were smaller than 25mm and 20 were between 25 and 50mm.

Total mussel population density was 2.75/m² in random 1m² quadrats in the vicinity of the upper Prairie du Sac free-release site during 2004. Densities by species are given in Table 4. No specimens of *L. higginsii* were found in these random samples. A total of 9.52% of the specimens

found were smaller than 25mm and 11.9% were between 25 and 50mm. Free diving samples were done at a location where we found a relatively large proportion of juvenile mussels. A total of 159 mussels were found here. Of these, 10.1% were smaller than 25mm and 25.5% were between 25 and 50mm.

Juvenile *L. higginsii* are probably so rare and scattered at Prairie du Sac, they are unlikely to show up in our samples. A total of 119,269 estimated transformers have been released here on free-ranging fish since 2001. If 1% of these survived, there would be about 1000 *L. higginsii* present at a density of 0.0022/m² - which is undetectable with the number of samples we took. We would have to take samples in an estimated area 450m² to locate one or collect about 1300 mussels. These estimates assume that all transformers were deposited by fish within the areas sampled. This is unlikely, since fish are known to move large distances, especially during spring. It is likely that some fish moved outside of the areas sampled unlike the caged fish at the Orion site.

Future monitoring at this location should concentrate on free diving where large numbers of juveniles could be found.

REFERENCES USED

Gordon, Roger. 2001. Lampsilis higginsi recovery project Genoa National Fish Hatchery. 2001. Genoa National Fish Hatchery, Genoa, Wisconsin. 8 pp.

Gordon, Roger and Tony Brady. 2003. Lampsilis higginsi recovery project Genoa National Fish Hatchery 2003. 10 pp.

Table 1. 2001-2004 Location, Date of Release, Release Method, Number of Each Fish Species & Population Strain for Propagated *L. higginsii* Released into the Wisconsin River, Wisconsin.

LOCATION	STA-TION	RIVER MILE	DATE OF RELEASE	LATITUDE LONGITUDE	METHOD (# OF CAGES)	FISH SPECIES	# OF FISH	EST. # OF L. HIGGINSII TRANS-FORMERS	MUSSEL "STRAIN"
Orion	89	48.42	13 June 2001	43º12'28.6" 90º21'59.8"	Mesh-bottomed cages (9)	M. dolomieu S. vitreum	445 150	34042	Hudson
Orion	"	"	23 June 2003	"	Mesh-bottomed cages (9)	M. salmoides	225	20700	Cassville
Orion	"	"	12 May 2004	"	Mesh-bottomed cages (11)	M. dolomieu	451	29789	Cassville
Orion	6	49.5	23 May 2003	43º12'37.3 "90º20'43.2"	Mesh-bottomed cages (17)	M. salmoides	425	39100	Cassville
Orion	"	"	12 May 2004	"	Mesh-bottomed cages (10)	M. dolomieu	410	27089	Cassville
Orion	3	48.66	12 May 2004	43º12'19.5" 90º21'38.6"	Solid-bottomed cages (6)	M. dolomieu	156	10307	Wisconsin R.
Prairie du Sac	68	89.16	13 June 2001	43º16'10.6" 89º43'17.9"	Free-release	M. dolomieu	450	25020	Hudson
Prairie du Sac	"	"	11 May 2004	"	Free-release	M. dolomieu	395	26101	Cassville
Prairie du Sac	127	91.44	29 April 2002	43º17'51.6" 89º43'34.2"	Free-release	M. dolomieu	300	16500	Wisconsin R.
Prairie du Sac	"	"	7 May 2003	"	Free-release	M. dolomieu	534	51748	Cassville (Wisconsin R. supplement)

Figure 1. 2004 Location of 55 0.25m² Quadrats done Downstream of the Lower Cage Site (Station 89) near Orion.

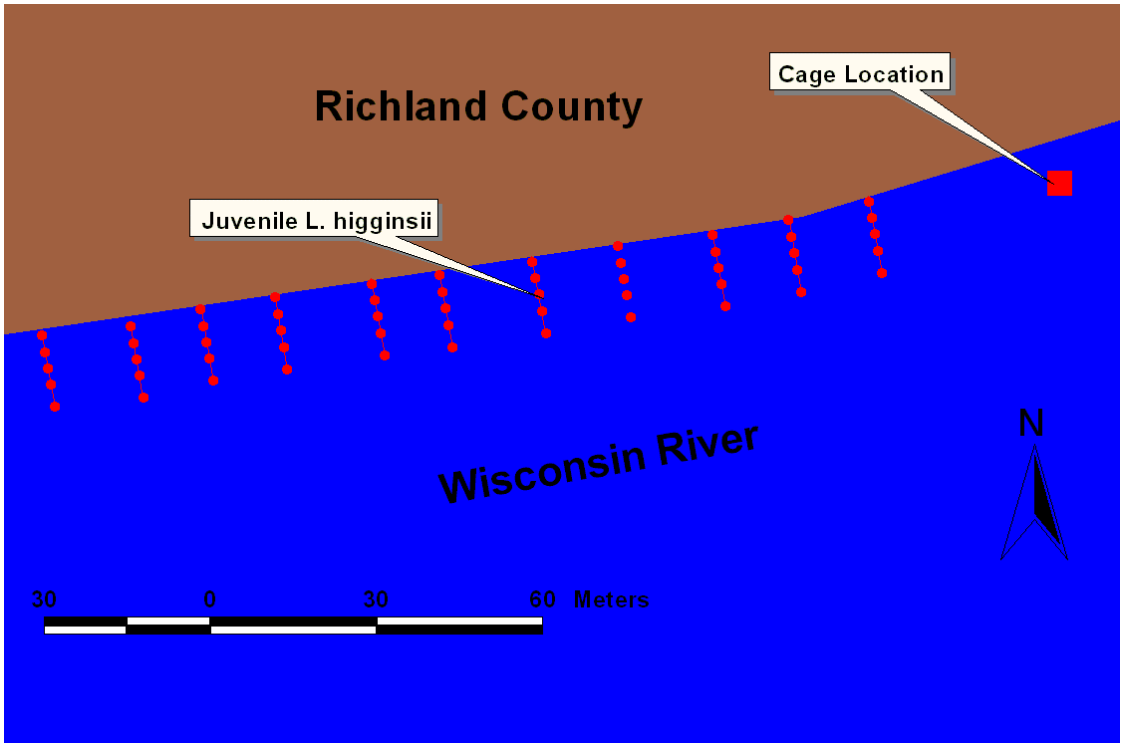

Figure 2. 2004 Location of 60 0.25m² Quadrats done Downstream of the Upper Cage Site (Station 6) near Orion.

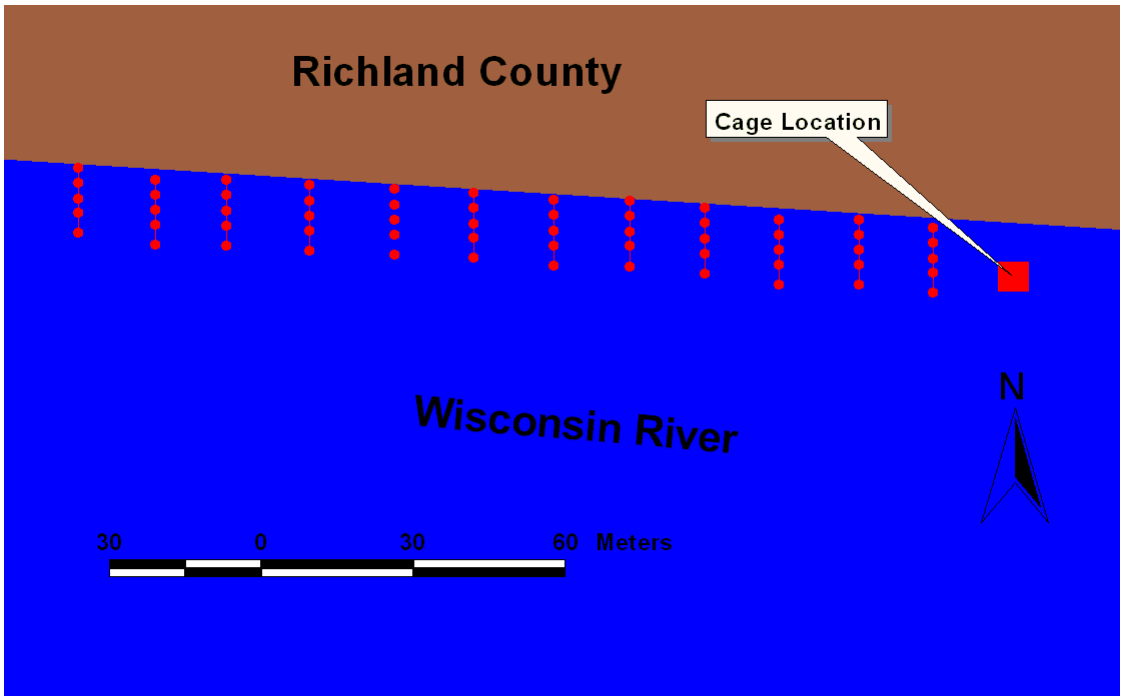

Figure 3. 2004 Solid-Bottomed Cage Site Location.

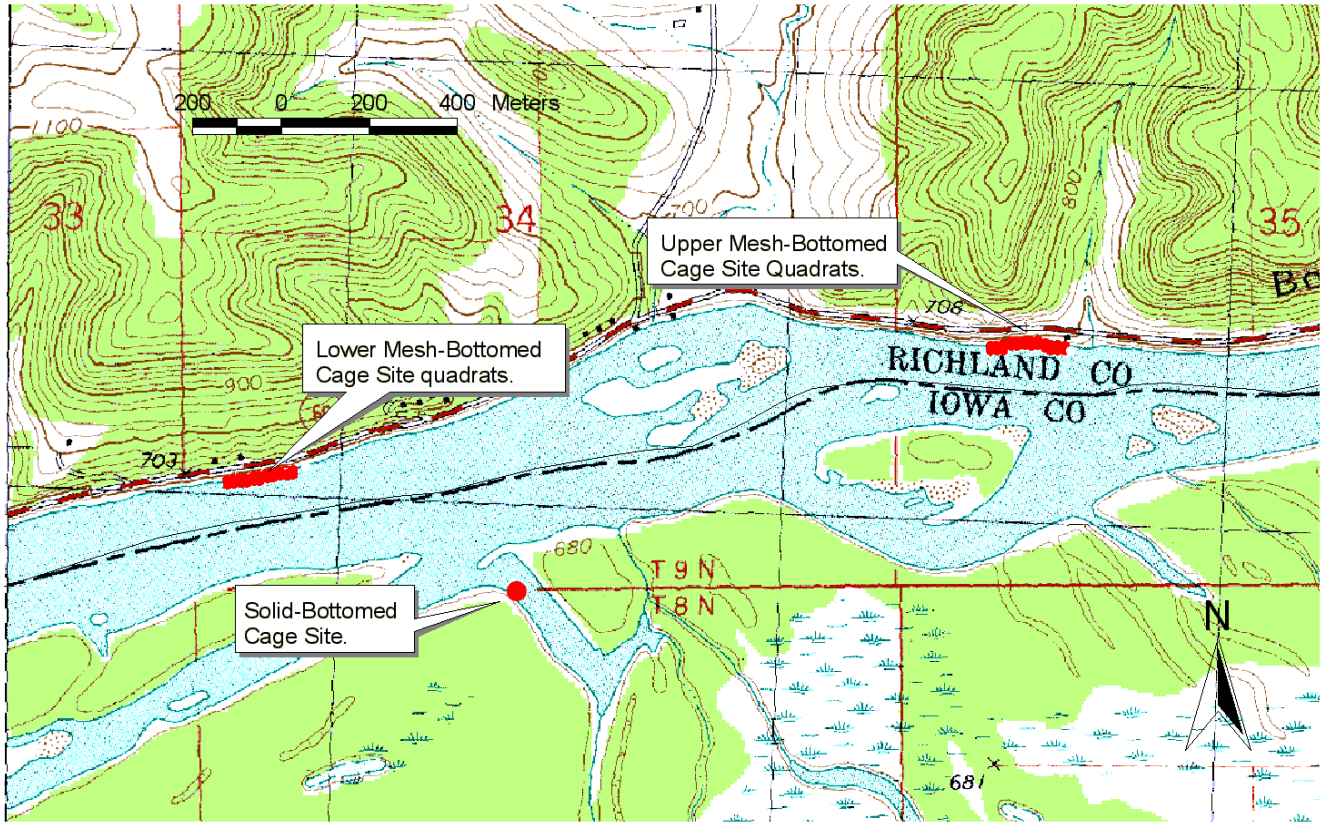

Figure 4. 2004 Location of 60 0.25m² Quadrats done Downstream of the Hwy 12 Fish Release Site (Station 68) near Prairie du Sac.

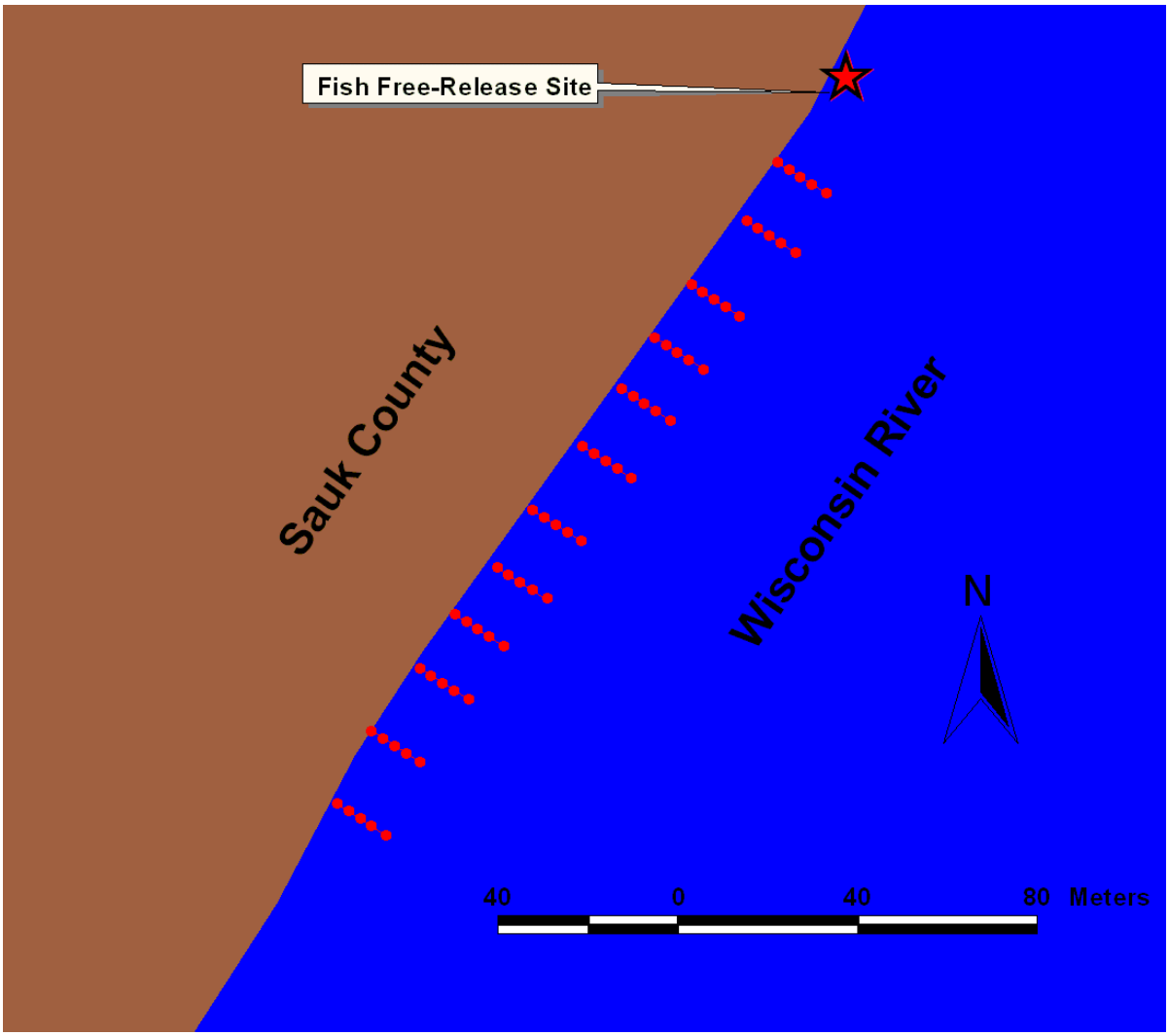

Figure 5. 2004 Location of 122 1m² Quadrats done Downstream of the Upper Cage Site (Station 127) near Prairie du Sac.

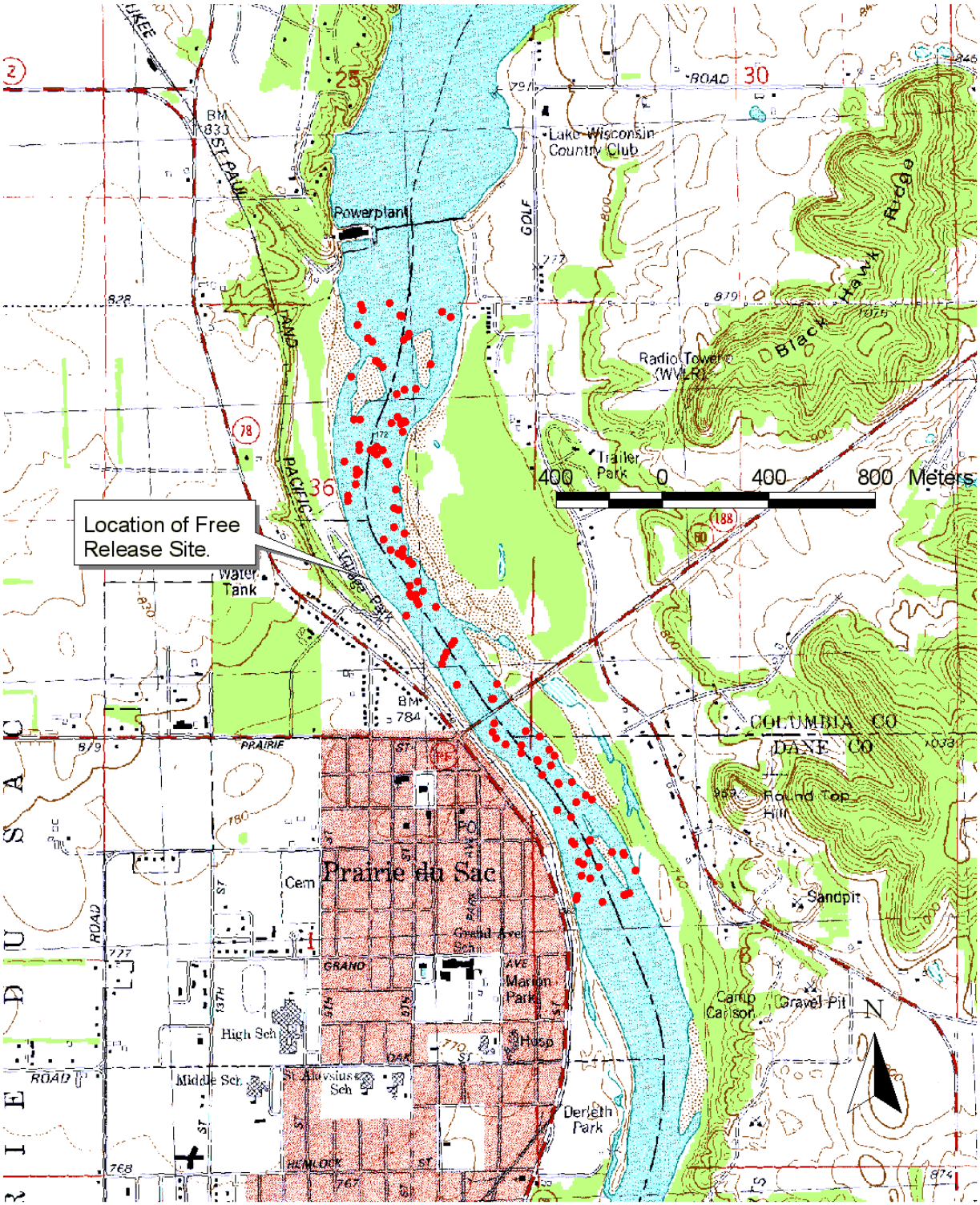

Table 2. 2004 Mussel Population Densities from 115 0.25m ² Quadrats done Downstream of two L. higginsii Release Sites on the Wisconsin R., near Orion.

TAXON	#/m ²	STD DEV
A. p. plicata	0.24	1.61
E. dilatata	0.14	0.91
F. flava	0.28	1.15
L. cardium	0.45	1.38
L. fragilis	0.21	0.89
L. higginsii	0.03	0.37
L. recta	0.03	0.37
O. olivaria	0.35	1.25
O. reflexa	0.07	0.53
P. alatus	0.10	0.64
Q. metanevra	0.10	0.64
Q. p. pustulosa	0.38	1.29
S. u. undulatus	0.03	0.37
T. donaciformis	0.03	0.37
T. verrucosa	0.35	1.25
ALL TAXA	2.82	5.08

Figure 6. *Lampsilis higginsii* Collected near the Lower Cage Site near Orion, Wisconsin, 2004.

Table 3. 2004 Mussel Population Densities from 60 0.25m ² Stratified Quadrats done Downstream of lower *L. higginsii* Free-Release Site on the Wisconsin R., near Prairie du Sac.

TAXON	#/m ²	STD DEV
A. p. plicata	0.33	1.11
F. flava	0.67	1.97
L. cardium	1.60	2.68
L. fragilis	0.20	1.15
L. recta	0.20	0.88
O. olivaria	0.20	0.88
P. alatus	0.07	0.52
Q. p. pustulosa	0.20	0.88
S. u. undulatus	0.07	0.52
T. verrucosa	0.07	0.52
ALL TAXA	3.60	4.64

Table 4. 2004 Mussel Population Densities from 122 1m ² Random Quadrats done in the Vicinity of the Upper *L. higginsii* Free-Release Site on the Wisconsin R., near Prairie du Sac.

TAXON	LIVE	STD DEV
A. p. plicata	0.39	1.49
F. flava	0.13	0.88
L. cardium	0.69	1.83
L. fragilis	0.23	1.07
L. recta	0.20	0.87
O. olivaria	0.30	1.28
O. reflexa	0.23	1.18
P. alatus	0.07	0.51
P. grandis	0.03	0.36
Q. metanevra	0.00	0.00
Q. p. pustulosa	0.43	1.44
T. donaciformis	0.03	0.36
T. verrucosa	0.03	0.36
ALL TAXA	2.75	5.47

Table 5. 2003 Mussel Population Densities from 20 1m ² Stratified Quadrats done Downstream of lower L. higginsii Free-Release Site on the Wisconsin R., near Prairie du Sac.

TAXON	#/m ²	STD DEV
A. p. plicata	0.10	0.31
F. flava	0.20	0.52
L. cardium	0.75	1.33
L. fragilis	0.50	1.00
L. recta	0.15	0.37
O. olivaria	0.20	0.52
P. coccineum	0.05	0.22
P. alatus	0.10	0.31
Q. p. pustulosa	0.20	0.70
ALL TAXA	3.60	4.64